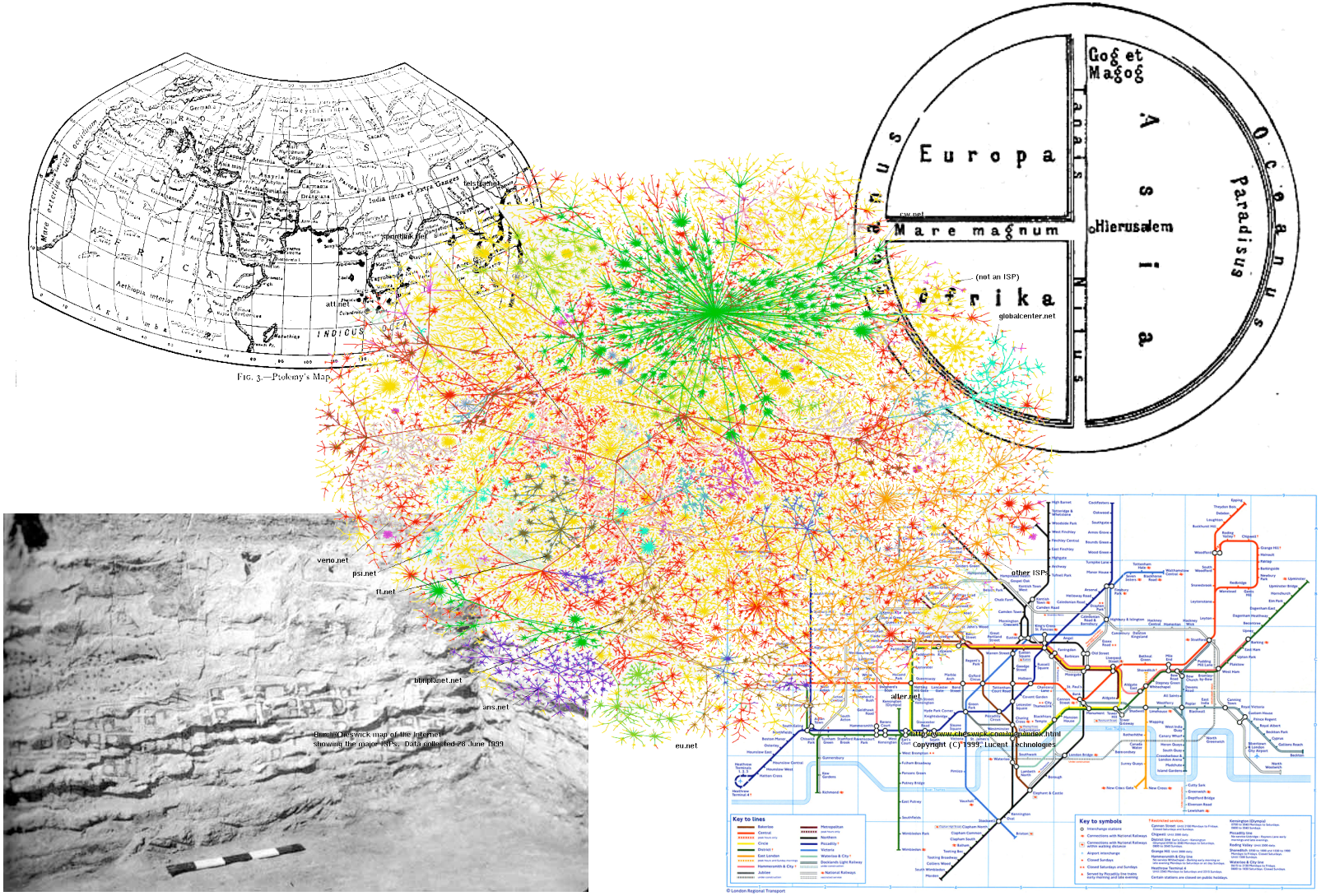
MAPS IN A (TINY) NUTSHELL

Outline

- What is a Map?
- Scale
- Planar Representations of a Sphere
- Projections
- Datum
- GIS
- Vector Representations
- Raster Representations
- Generalization
- Data Aquisition
- Classification / Ontologies / Semantic Web

Map? Take I


Europa
Asia
Mare magnum
Hierusalem
Gog et Magog
Paradisus
Nilus
Tanais
Fig. 3.—Ptolemy's Map.
(not an ISP)
globalcenter.net
other ISPs
veno.net
psi.net
fl.net
bbnplanet.net
ans.net
uu.net
eu.net
Copyright (C) 1999, Lucent Technologies
Key to lines
Key to symbols

Map? Take II

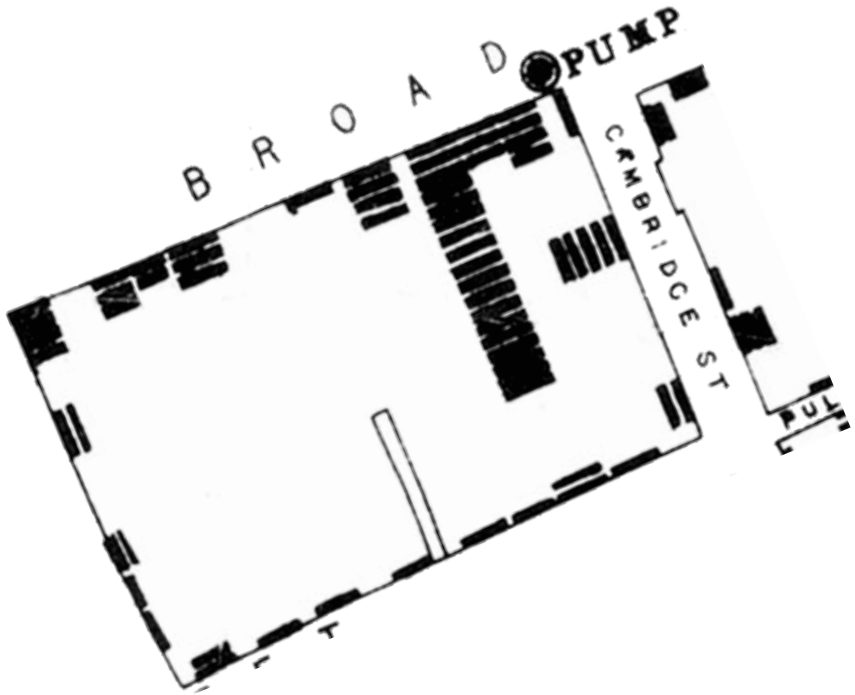
- A map is a **simplified depiction of a space**, a navigational aid which highlights relations between objects within that space.
- Most usually a map is a two-dimensional, geometrically accurate representation of a three-dimensional space. The science and art of map-making is cartography.
- Map-making dates back to the Stone Age and **appears to predate written language by several millennia**. One of the oldest surviving maps is painted on a wall of the Catal Huyuk settlement in south-central Anatolia (now Turkey); it dates from about 6200 BC.

  » http://en.wikipedia.org/wiki/Map

Maps? Take III

- Maps (are pictures that) tell stories (ref Schuyler Erle and others)





- …and might reveal hidden facts.

Map? Take IV

- Map: World Model
- Step 1: Identify the **features** to be modeled:
  - Tangible: bridges, railroads, parking lots, etc.
  - Non-tangible:
    - abstract (form and pattern): corners, edges, nodes, surface
    - processes (manipulating form and pattern): ocean currents, cold air masses, toxic waste plumes
- Step 2: Represent (graphically) the features and their spatial relations

History of Maps

- Ref Schuyler Erle:
  - » http://mappinghacks.com/talks/software_2006/

The cartographer's dilemma

- "That's another thing we've learned from your Nation," said Mein Herr, "map-making. But we've carried it much further than you. What do you consider the largest map that would be really useful?"
- "About six inches to the mile."
- ""Only six inches!"exclaimed Mein Herr. "We very soon got to six yards to the mile. Then we tried a hundred yards to the mile. And then came the grandest idea of all! We actually made a map of the country, on the scale of **a mile to the mile**!"
- "Have you used it much?" I enquired.
- "It has never been spread out, yet," said Mein Herr: "the farmers objected: they said it would cover the whole country, and shut out the sunlight! So we now **use the country itself, as its own map**, and I assure you it does nearly as well.

» Lewis Carrol, Chapter 9: The Man in the Moon, in *Sylvie and Bruno Concluded*, 1893

On Exactitude in Science

- ...In that Empire, the craft of Cartography attained such Perfection that the Map of a Single province covered the space of an entire City, and the Map of the Empire itself an entire Province. In the course of Time, these Extensive maps were found somehow wanting, and so the College of Cartographers evolved **a Map of the Empire that was of the same Scale as the Empire and that coincided with it point for point**. Less attentive to the Study of Cartography, succeeding Generations came to judge a map of such Magnitude cumbersome, and, not without Irreverence, they abandoned it to the Rigours of sun and Rain…

  » Jorge Luis Borges and Adolfo Bioy Casares. English translation quoted from J. L. Borges, A Universal History of Infamy, Penguin Books, London, 1975.

- …When the map is installed over all of the territory (whether suspended or not), the territory of the empire has the characteristic of being a territory entirely covered by a map. The map does not take account of this characteristic, **which would have to be presented on another map that depicted the territory plus the lower map**. But such a process would be infinite.

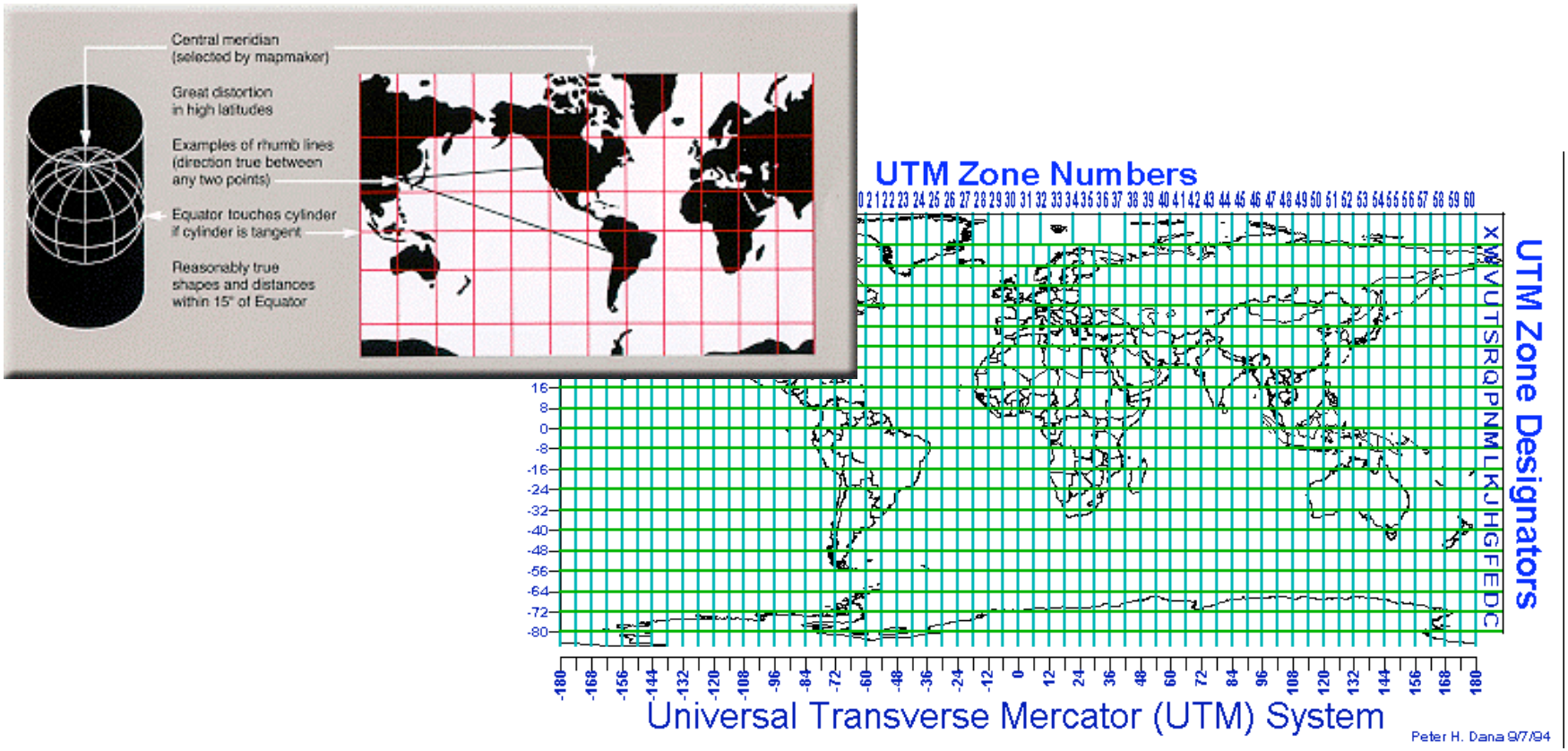
  » Eco, Umberto. (1994). On the Impossibility of Drawing a Map of the Empire on a Scale of 1 to 1. In: How to . New York: Harcourt. pp. 84-94.

Coordinate Systems

- Euclidian (2D, 3D, ND)
- Polar coordinates
- Cylindric
- Spherical -> geographic, latitude/longitude

Map Projections

- Geographic, latitude/longitude
- Universal Transversal Mercator, UTM



Datum

- WGS 84
- Horizontal
- Vertical

Unambigious Position

- Horizontal datum
- Projection
- North/east coordinates
- Vertical datum
- Height

- Mixing datums/projections may be fatal in for instance navigational applications

GIS

- Geographic Information Systems (from 1965)
- Geographic Information Science (from 1995)
- Geographic Information Services (from 2004)

Vector Representations

- Point
- Line
- Polygon
- Attributes

Raster Representations

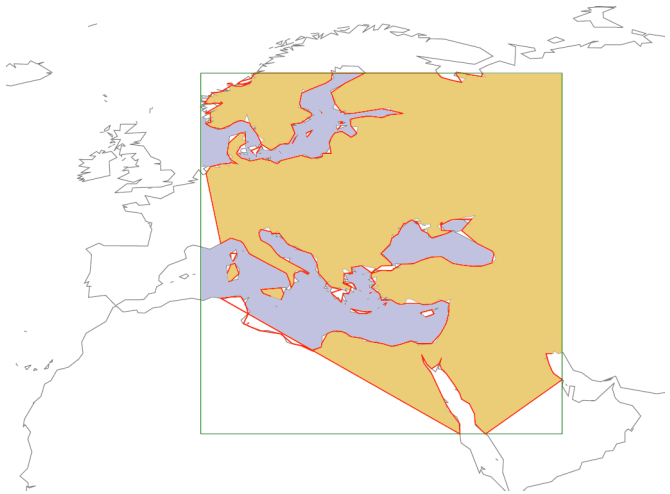
- Scanned paper maps
- Aerial photography (orthophoto)
- Satellite imagery (visible/non-visible spectra)

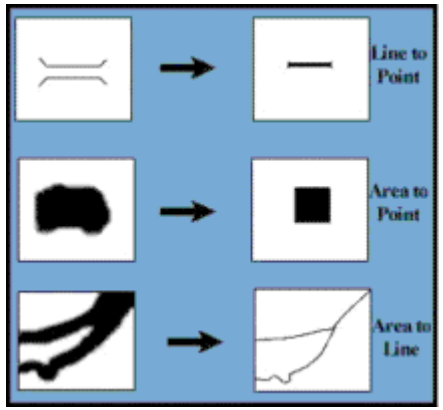
Cartographic Generalization

- When zooming out, the reduce information density must be reduced, otherwise information overflow/cluttering
- Selection:
  - Aggregation (merging of several elements, most common with areas)
  - Elimination (removal of certain elements: points, lines and areas)
  - Smoothing (removal of details in shape or outline: lines and areas)



- Simplification:





Data Aquisition

- Traditional (ground) surveying
  - Theodolits
  - Triangulation
  - ”Fastpunkter” (Trigonometric networks)
- Aerial photography
- Satellite imagery
- Remote sensing
- Bathymetry
- Multibeam echo soundings
- Laser scanning